# A Multi-Platform Approach To Examining Variability In The Kuroshio Off The Coast Of Japan

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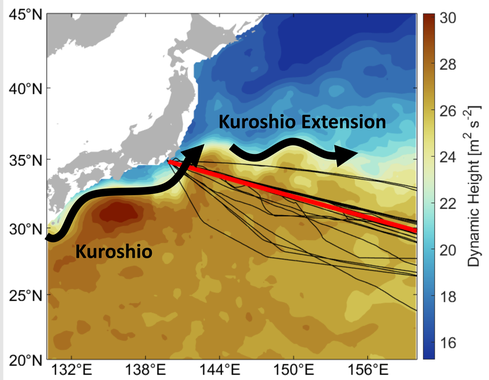
## Motivation

> The Kuroshio is the subtropical western boundary current of the North Pacific.

> It transports warm water and influences regional weather and ocean temperature.

> There are a lack of long-term in situ measurements of the Kuroshio.

**The aim of this work is to study Kuroshio variability in the upper 1975-m using a time series of cross-transect velocity produced by combining sustained measurements from three different global ocean observing platforms over 2004—2019.**




Location of the nominal high-resolution expendable bathythermograph (HR-XBT) transect off Japan, and of each individual transect occupation. Underlying map is the 2004—2018 mean dynamic height at the surface relative to 1975 dbar computed from the Argo 1/6° climatology (Roemmich and Gilson, 2009).

## Methods

Apply Zilberman et al. (2018) method to combine measurements from HR-XBT network, Argo floats, and satellite altimetry.

1) Argo T-S relationships infer salinity for HR-XBT temperature profiles (0—800-m).
2) Argo climatology corrects for path differences in individual transect occupations.
3) Argo profiles extend measurements from 800-m to 1975-m.
4) Satellite altimetry produces monthly time series from ~quarterly HR-XBT sampling.
5) Argo sub-surface velocities provide reference velocity at 1000-m.

**Acknowledgements**

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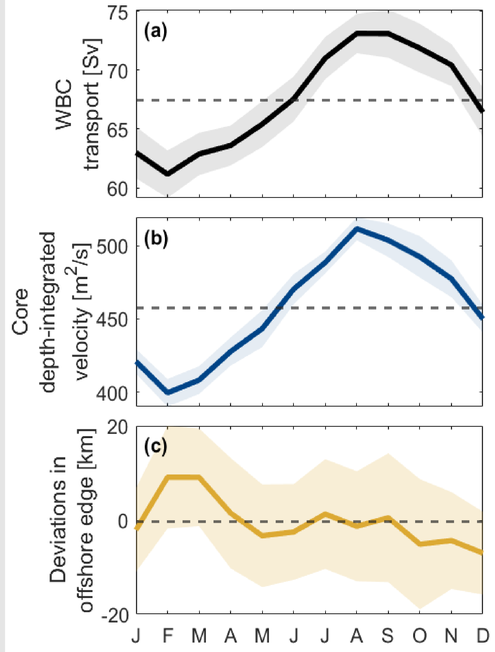
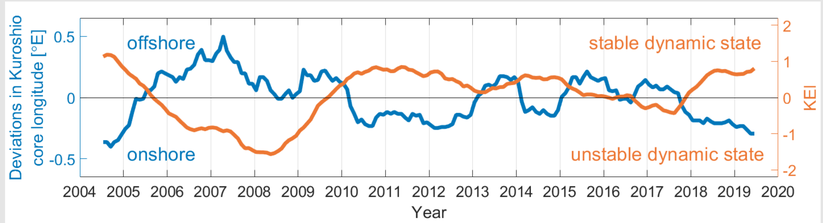
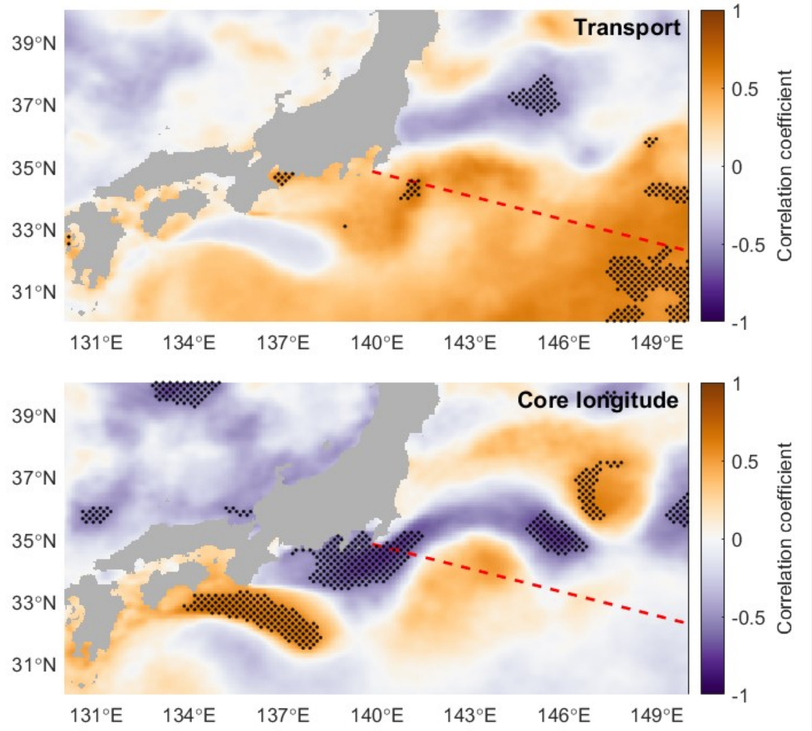



Annual cycles in the Kuroshio for:
(a) Transport [1 Sv ≡ $10^6$ m$^3$ s$^{-1}$]; positive values are northward.
(b) Core depth-integrated velocity; positive values are northward.
(c) Deviations in the offshore edge; positive values are eastward (i.e. offshore).

Transport and core depth-integrated velocity show clear annual cycles that are consistent with each other, suggesting that the annual cycle in Kuroshio transport is driven by changes in the speed of the current rather than by changes in the width of the current.




Interannual variability in the Kuroshio core longitude and the Kuroshio Extension Index (KEI) from Qiu et al. (2014). The two time series are anti-correlated (r = -0.73) indicating that the location of the Kuroshio core is related to the dynamic state of the Kuroshio-Kuroshio Extension system.




Correlations between interannual variability in satellite SST anomaly with Kuroshio transport (top) and core longitude (bottom). Stippling indicates where correlations are significant at the 90% level. Positive correlations indicate an increase/decrease in SSTa as transport increases/decreases or as the core moves further offshore/onshore, illustrating how changes in the location of the Kuroshio core can cause changes in SST.

## Future Work

> Explore the relationship between Kuroshio variability and regional ocean temperature (surface and sub-surface).

> Explore occurrence of marine heatwaves in this region of the Kuroshio.

**References**

Roemmich and Gilson. 2009. The 2004—2008 mean and annual cycle of temperature, salinity, and steric height in the global ocean from the Argo program. *Prog Oceanogr.*

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